

[54] **ELECTRONIC MUSICAL INSTRUMENT
WITH SINGLE KEYBOARD PROVIDING
SOUNDS AND EFFECTS**

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84/DIG. 4, DIG. 11

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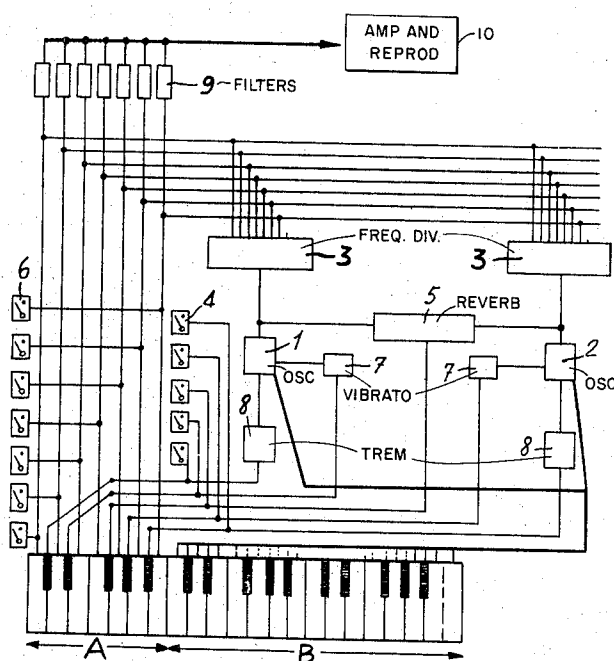
Primary Examiner—Richard B. Wilkinson

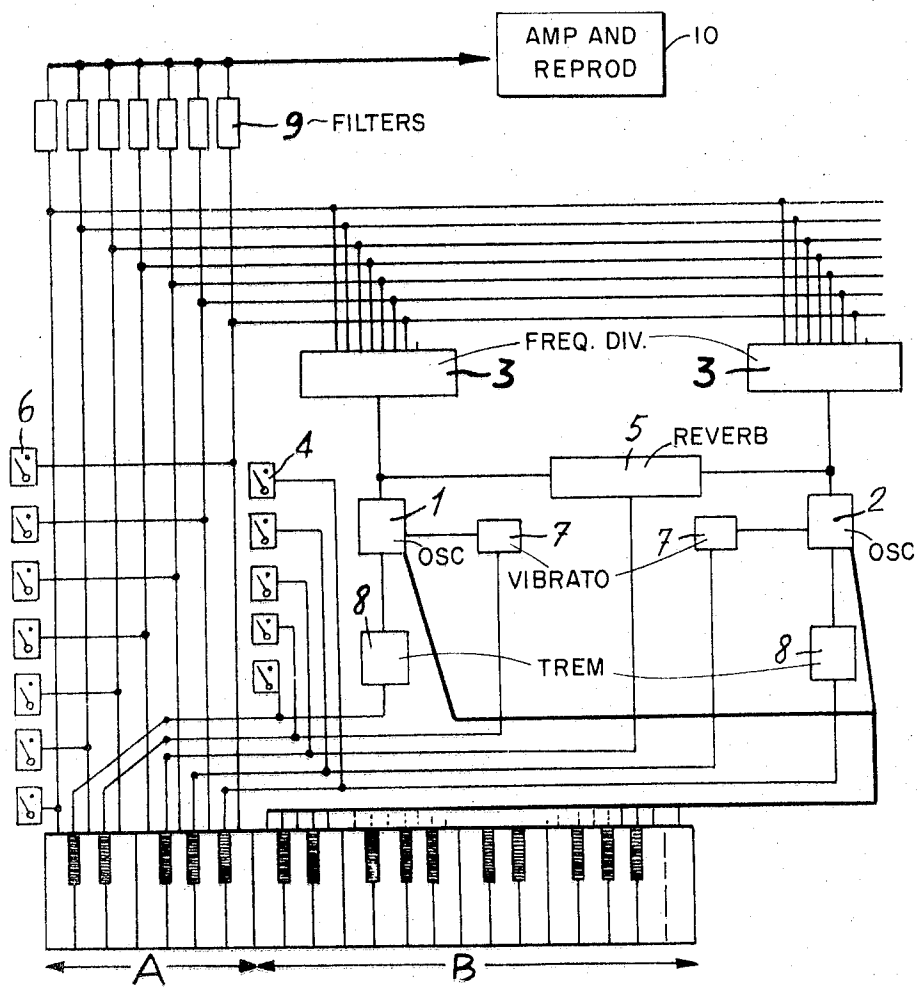
Assistant Examiner—Stanley J. Witkowski

[57] **ABSTRACT**

An electronic sound oscillator comprising at least one electronic note generator connected to a variable frequency control means, said note oscillator being connected to the input of a frequency divider circuit having as many outputs as the octaves to be provided for each of the notes generated by said generator, and pushbutton-type electrical contact devices to connect each of the outputs associated with the several octaves of the frequency divider circuit to at least one sound amplifying and reproducing circuit, said electrical contact devices being aligned with one another for operation by one hand of a musical performer.

8 Claims, 1 Drawing Figure





ELECTRONIC MUSICAL INSTRUMENT WITH SINGLE KEYBOARD PROVIDING SOUNDS AND EFFECTS

BACKGROUND OF THE INVENTION

This invention relates to an electronic sound generator having frequency dividers of multiple design for a plurality of octaves enabling a player to select insert such octaves both separately and simultaneously by means of keys, pushbuttons or the like, one of which is provided for each of said octaves.

At present, available electronic music generators, while having remarkable features as to technical capabilities concerning timbres and other particular musical effects, suffer from the disadvantage of being impractical when directly used in an orchestra, since the controls are not readily usable either because of the external structure of these apparatuses, or because of the technical structure and control complexity thereof.

The following are the basic principles according to which such apparatuses are made: the apparatuses comprise one or more note generating oscillators, each of which at all times is capable of generating any note in the full audible range, and even more. In these standard available apparatuses the frequency control, i.e., note selection, is accomplished by an ordinary organ type of keyboard.

In order to include the usual sound frequency range, a keyboard should have arrange of at least 10 octaves (120 keys), a size which would be evidently objectionable. Instead, a keyboard portion spanning 3 to 5 octaves is used, and an associated shifting switch or similar device is used to enables shifting of the note generator frequency to the desired note range to be played, i.e. the frequency range of the available keyboard is caused to slide (as to frequency) over the span of frequencies intended to be used. Consequently, tones that are in a presently unselected frequency range are not presently represented on the keyboard and are therefore not instantaneously available.

This requires a performer to discontinue his performance, at least for a fraction of a second, in order to set the apparatus for the next passage, which greatly prejudices the expressive artistic result.

Since the frequency range filled or bridged by each of the oscillators comprising such apparatuses is continuous throughout the entire range of the apparatus, (for example, from 16 Hz. to 16 KHz.), and since only one frequency for each oscillator is available for each key, standard apparatuses having 2 or 3 oscillators are thus provided with only 2 or 3 notes actuatable by each key. These problems restrict practical expressive capabilities of presently known apparatuses, particularly when performing in the presence of an audience.

SUMMARY OF THE INVENTION

It is the object of the present invention to provided an electronic sound generator capable of producing by means of each of its keys, both separately and simultaneously, one or all of the harmonic and subharmonic frequencies of that note for each of its available note generators, i.e., in musical terms, capable of producing all of the lower and upper harmonics in the musical scale for said note; and the sound generator is capable of this for as many times as the number of oscillators comprised in the apparatus.

Therefore, although its keyboard has only one or more octaves, the instrument is provided with the full range of the sound frequencies the apparatus is fitted with.

This result has been achieved by using the note generating oscillators and causing them to continuously oscillate only for one or more octaves of the frequency range, and connecting in cascade thereto a number of electronic frequency dividers. The output signals to be supplied are not taken from the oscillators, but from each divider. Thus, as many signals are provided as there are dividers, which signals are exactly spaced apart by one musical octave from one another. The purpose of providing several notes from each key either individually or concurrently, has been achieved by arranging, at the output of each frequency divider contacts that are controllable by means of pushbuttons or the like to enable inserting said signals selectively into the music as desired by the performer.

All of said pushbuttons are operated with a single hand by the musical performer, said pushbuttons forming a special purpose keyboard, in a practical embodiment may be in the form of a piano or organ type of keyboard.

BRIEF DESCRIPTION OF THE DRAWING

Further features and advantages of the invention will become apparent from the following detailed description, given by way of non-limiting example, in connection with a preferred embodiment showing the technical details of the invention, reference being had to the accompanying drawing, in which:

The single figure is a single-line type of block diagram showing the electronic circuit and keyboard.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Generally, an electronic sound generator according to the invention comprises at least one electronic note oscillator which is connected to a variable resistor frequency control means, said oscillator being connected to the input of a frequency divider circuit having as many outputs as the octaves to be provided, and a pushbutton type of electrical contact means operable to connect the outputs corresponding to the several octaves of the frequency divider circuit to at least one sound amplifying and reproducing circuit, said electrical contact means being arranged aligned to one another for operation by one hand of a musical performer.

In a preferred embodiment, a generator is provided with an organ-piano type of keyboard which is divided into two parts. A first part, such as the right-hand part, is used as a standard sound keyboard, and may have as many keys as an organ or piano keyboard. A second part, such as the left-hand part, is a special-purpose keyboard, some keys of which, such as the white keys, are for controlling the frequency divider circuits for inserting the several octaves. The remaining keys, such as the black keys, are used for inserting the sound or expression effect circuits or devices, for each of the notes being played on the right-hand part of the keyboard.

In parallel with the electrical contacts in the second part of said keyboard, corresponding control switches are provided, so as to provide both (a) fast and intermittent insertion of the octaves and/or desired effects by pressing down and releasing the associated key or

keys in the second part of said keyboard, and (b) continuous insertion for the octaves and/or the desired effects, by means of said corresponding control switches.

This novel electronic sound generator enables a musical performer to execute the melodic theme with his right hand on the right-hand part of the keyboard or instrument control part assigned thereto, and, by acting on the aforesaid special-purpose keyboard, to readily insert with his left hand at the same time one or more or all of the octaves, and the several effects as well, thereby obtaining timbre, chord and frequency shift combinations that are not obtainable by the conventional systems. The electronic circuit and keyboard, for simplicity, comprises a standard two-octave keyboard B for musical performance and a keyboard A, wherein the white keys are used for controlling the octave insertion, and the black keys are used for the electronic effects. In the present example, the electronic circuit comprises two electronic note oscillators 1 and 2, each of which is connected to the input of an associated multiple frequency divider 3 having a plurality of cascade dividers and an equal number of outputs corresponding thereto. If the oscillators 1 and 2 oscillate at harmonically higher frequencies than the frequency range involved and their frequencies are reduced by one or more octaves, the lower frequencies are provided from said dividers 3.

Said oscillators 1 and 2 may be tuned in unison or harmony and to any other musical combination (such as, at third, fifth, seventh musical intervals, etc.) and are controlled by the closure of electrical contact means (not shown) of the pressure type, operable by pressing on the associated keys of the keyboard. Said dividers 3 can be electrically interconnected in parallel, as shown in the drawing, to an amplifier circuit (not shown), or separately connected.

The frequency dividers 3, which are controlled by the closure of pressure-type electrical contact means (not shown), such as contact means operable by pressing on the associated keys in the keyboard, provide for the lower octaves of the notes being played by the keyboard portion B, and are electrically connected to the white keys of the special-purpose keyboard A shown on the left-hand side of the drawing, as mentioned above.

As shown, electronic reverberation devices 5, frequency variation means 7, vibration devices 8, etc., (these being also known, in musical terminology, as cathedral effect devices 5, vibrato means 7, and tremolo devices 8), are connected to the several note generators 1 and 2. These devices can be controlled by corresponding keys of keyboard A, which in the present example are the black keys; as well as by any other electrical pushbutton or switch 4 electrically connected in parallel with the associated contacts of the black keys of said keyboard A.

Similarly, a respective switch 6 or the like is electrically connected in parallel with each of the white keys of keyboard A, making it possible to keep inserted one or more octaves, continuously inserted, along with the foregoing as well as the desired effects.

A possible filter 9, series connected to the output of each octave, will enable achievement of a desired timbre effect for each of the octaves. The output filters 9 connect to a sound amplifying and reproducing circuit 10.

From the foregoing it will be appreciated that by means of the electrical contacts controlled by the keys in the special-purpose keyboard A, one or more signals (whose frequencies are set by a key of the keyboard B) can be selected and inserted in the number and combinations desired for the musical performance.

As to the operation of the electronic sound generator according to the invention, it should be noted that by means of the present invention a performer can insert, the musical effects and note octaves that are desired, by normal pressure on the keys of the keyboard A with his left hand, for the notes being played with his right hand on the keyboard B.

Thus, timbre, tune, frequency shift combinations and other effects are provided, which are impossible to obtain otherwise.

Of course, no restrictions are set as to the number of octaves available from the frequency dividers, the number of oscillators intended to be used in the apparatus, for other possible filters, effects, etc., intended to be included in the generator. The same is true for the control section of the generators which, in a simplified embodiment, comprises an organ-piano type of keyboard, but which could be made in another form or system, such as by a pedal keyboard control or any potentiometric type of control.

Of course, the embodiments and practically all of the structural details can be widely varied from the matter herein described and shown, without departing from the scope of the present invention if the principal of the invention is unaltered.

I claim:

1. An electronic sound generator comprising at least one electronic note oscillator; a first portion of a keyboard connected to said oscillator to control by means of a first hand of a musical performer the frequency of the oscillator, said oscillator being connected also to the input of a frequency divider circuit having at least as many outputs as the octaves to be provided for the notes generated by said generator, and a plurality of push-type electrical contact means arranged as a second portion of a keyboard and each for connecting the respective output corresponding to one of the several octaves of the frequency divider circuit to at least one sound amplifying and reproducing circuit, said second portion of keyboard being arranged for operation by a second hand of the musical performer and being in alignment with said first portion of keyboard.

2. An electronic generator as claimed in claim 1 and provided with a set of electrical switch means each of which is connected in parallel with a respective one of said electrical contacts means and operable for inserting the respective octaves continuously.

3. An electronic sound generator as claimed in claim 1 and wherein said electrical contact means comprise keys of a portion of an organ-piano type of keyboard.

4. An electronic sound generator as claimed in claim 1 and further comprising devices connected to said oscillator and operable to provide particular sound effects, and wherein each of said devices sound effect is actuatable respectively by one of a plurality of further electrical contact means aligned with one another for operation by means of one hand of a musical performer.

5. An electronic sound generator as claimed in claim 4 and wherein said keyboard is an organ-piano type of

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keyboard and said further electrical contact means for the particular sound effects are operable by keys of said second portion of keyboard.

6. An electronic sound generator as claimed in claim 4 and further comprising a plurality of electrical switch means each connected in parallel with a respective one of said further electrical contact means and operable for producing said particular sound effects continuously.

7. An electronic sound generator as claimed in claim 1 and further comprising means connected to said oscillator and operable for providing particular sound effects, additional electrical contact means for actuating

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said sound effect means, and wherein said first and second portions of keyboard comprise an organ-piano type of keyboard including means whereby a first color of the keys of said second portion is arranged for operating said push-type electrical contact means and a second color of the key of said second portion is arranged for operating said additional electrical contact means.

8. An electronic sound generator as claimed in claim 1 and comprising two or more electronic note oscillators having means for enabling tuning in unison, in harmony, and in other frequency combinations.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,840,690

Dated October 8, 1974

Inventor(s) Athos Davoli

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

After the United States application data, please insert the foreign application priority data as follows:

--Foreign Application Priority Data
April 19, 1972 Italy..42509 A/72--

Signed and sealed this 14th day of January 1975.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents